

REMARKS

The outstanding Action has been received and carefully noted. The following remarks are submitted as a full and complete response thereto. Claims 3, 9 and 15 have been cancelled without prejudice or disclaimer. Claims 1, 2, 7, 8, 13, 14 and 19 have been amended to further set forth the invention. No new matter has been added. Accordingly, claims 1, 2, 4-8, 10-14 and 16-19 are now pending in this application and submitted for consideration, of which claims 1, 7, 13 and 19 are in independent form.

Formal Matter Objections

The title of the invention is objected to as being non-descriptive.

In response, a new title is submitted herewith to read "DC-DC CONVERTER WITH CONTROL CIRCUIT CAPABLE OF GENERATING STEP-UP AND STEP-DOWN SIGNALS".

The drawings are objected to due to certain blank boxes in Figures 5 and 11.

Attached is a Request for Approval of Drawing Corrections. Particularly, boxes 13, 14, 15, and 16 in Figures 5 and 11 have been amended to include "Soft-start", "Short-circuit Detection", "Oscillation", and "Reference Voltage Generation", respectively.

Prompt approval thereof is respectfully requested.

Prior Art Rejections

Claims 1-3, 7-9, 13-15 and 19 are rejected under 35 U.S.C. §102(b) as being anticipated by APA (Applicants' Prior Art).

The rejection to claims 3, 9 and 15 is now moot in view of the cancellation thereto.

The present invention is directed to a DC-DC converter with a control circuit that generates a control signal from a switching signal generation circuit within the control circuit. Particularly, the control signal in the form of a step-up signal or a step-down signal is generated by a comparator within the switching signal generation circuit.

By contrast, APA does not disclose, teach or suggest the comparator or its function thereof as now set forth in claims 1, 7, 13 and 19 from which other pending claims depend. More specifically, instead of generating a switching signal using the comparator in the switching signal generation circuit, APA merely receives a switching signal from an external terminal or device in order to switch between a step-down operation and a step-up operation. Such addition of the external terminal or device for handling the switching signal is undesirable since the number of external terminals are adversely increased. By contrast, the comparator of the claimed invention generates a switching signal from within the control circuit, and therefore it is not necessary to provide an external terminal, which in turn reduces the number of external terminals.

Claims 4-6, 10-12 and 16-18 are rejected under 35 U.S.C. §103(a) as being unpatentable over APA.

Claims 4-6, 10-12 and 16-18 depend directly or indirectly from claims 1, 7 and 13, respectively. Therefore, claims 4-6, 10-12 and 16-18 are also patentable over APA for at least the reasons stated above with respect to claims 1, 7 and 13, as amended.

In view of the above remarks, the Applicants respectfully submit that each of claims 1, 2, 4-8, 10-14 and 16-19 recites subject matter which is neither disclosed nor suggested in the cited prior art. Applicants also submit that this subject matter is more than sufficient to render the claimed invention unobvious to a person of ordinary skill in the art. Applicants therefore request that all pending claims be found allowable, and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the Applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

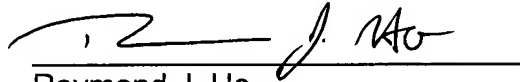
In the event this paper is not timely filed, the Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any

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additional fees may be charged to Counsel's Deposit Account No. 01-2300, making reference to attorney docket number 108075-00078.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'J. Ho', is written over a horizontal line.

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MARKED-UP COPY OF AMENDED CLAIMS

1. (Amended) A control circuit of a DC-DC converter that generates either one of a step-down control signal and a step-up control signal, the control circuit comprising:

a switch circuit for outputting ~~[either one of]~~ the step-down control signal [and the step-up control signal] in response to a first switching signal and outputting the step-up control signal in response to a second switching signal; and

a switching signal generation circuit connected to the switch circuit for selectively generating the first and second switching ~~[signal]~~ signals using a duty setting signal, which controls either one of the step-down control signal and the step-up control signal, wherein the switching signal generation circuit includes a comparator for comparing the duty setting signal with a reference voltage including the maximum voltage of a triangular wave signal, and wherein, based on a comparison result, the comparator generates the first switching signal when the duty setting signal represents a step-down operation and generates the second switching signal when the duty setting signal represents a step-up operation.

2. (Amended) The control circuit according to claim 1, wherein the reference voltage includes a median voltage between the maximum voltage of the triangular wave signal and a voltage corresponding to a predetermined percent of the maximum voltage,

and wherein the ~~[switching signal generation circuit]~~ comparator compares the voltage of the duty setting signal with ~~[a reference]~~ the median voltage ~~[to generate the switching signal]~~.

7. (Amended) A control circuit of a DC-DC converter comprising:

a first PWM comparator for comparing an input signal, a duty setting signal, and a triangular wave signal to generate either one of a first step-down control signal and a first step-up control signal;

a second PWM comparator for comparing the input signal and the triangular wave signal to generate either one of a second step-down control signal and a second step-up control signal;

a switch circuit connected to the first and second PWM comparators for outputting ~~[either]~~ the first and second step-down control signals in response to a first switching signal ~~[or]~~ and outputting the first and second ~~[step-down]~~ step-up control signals in response to a second switching signal; and

a switching signal generation circuit connected to the switch circuit for selectively generating the first and second switching ~~[signal]~~ signals using the duty setting signal, wherein the switching signal generation circuit includes a comparator for comparing the duty setting signal with a reference voltage including the maximum voltage of the triangular wave signal, and wherein, based on a comparison result, the comparator generates the first switching signal when the duty setting signal represents a step-down

operation and generates the second switching signal when the duty setting signal represents a step-up operation.

8. (Amended) The control circuit according to claim 7, wherein the reference voltage includes a median voltage between the maximum voltage of the triangular wave signal and a voltage corresponding to a predetermined percent of the maximum voltage, and wherein the [switching signal generation circuit] comparator compares the voltage of the duty setting signal with [a reference] the median voltage [to generate the switching signal].

13. (Amended) A DC-DC converter including a step-down circuit for decreasing an input voltage to generate a step-down output voltage or a step-up circuit for increasing the input voltage to generate a step-up output voltage, the DC-DC converter comprising:

a control circuit connected to the step-down circuit or the step-up circuit for generating either one of a step-down control signal, which controls the step-down circuit, or a step-up control signal, which controls the step-up circuit, wherein the control circuit includes;

a switch circuit for outputting [either one of] the step-down control signal in response to a first switching signal and outputting the step-up control signal in response to a second switching signal; and

a switching signal generation circuit connected to the switch circuit for selectively generating the first and second switching [signal] signals using a duty setting signal, which controls the duty of either one of the step-down control signal and the step-up control signal, wherein the switching signal generation circuit includes a comparator for comparing the duty setting signal with a reference voltage including the maximum voltage of a triangular wave signal, and wherein, based on a comparison result, the comparator generates the first switching signal when the duty setting signal represents a step-down operation and generates the second switching signal when the duty setting signal represents a step-up operation.

14. (Amended) The DC-DC converter according to claim 13, wherein the reference voltage includes a median voltage between the maximum voltage of the triangular wave signal and a voltage corresponding to a predetermined percent of the maximum voltage, and wherein the switching signal generation circuit compares the voltage of the duty setting signal with [a-reference] the median voltage [to generate the switching signal].

19. (Amended) A method for controlling a DC-DC converter including a step-down circuit or a step-up circuit, the method comprising the steps of:

generating either one of a step-down control signal, which controls the step-down circuit, or a step-up control signal, which controls the step-up circuit;

comparing a duty setting signal with a reference voltage including the maximum voltage of a triangular wave signal, wherein the duty setting signal controls the duty of either one of the step-down control signal and the step-up control signal;

~~[generating a switching signal using a duty setting signal, which controls the duty of either one of the step-down control signal and the step-up control signal; and]~~

generating a first switching signal for selecting the step-down control signal when the duty setting signal represents a step-down operation based on a comparison result;

generating a second switching signal for selecting the step-up control signal when the duty setting signal represents a step-up operation based on the comparison result;

providing ~~[either one of]~~ the step-down control signal ~~[and the step-up control signal]~~ to the ~~[associated]~~ step-down circuit ~~[or step-up circuit]~~ in response to the first switching signal; and

providing the step-up control signal to the step-up circuit in response to the second switching signal.